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Hand of a Man; insomuch that the Sparks, proceeding from those several Bodies, will also kindle the same Essence.

If such fluid Bodies, as are usually kindled by Flame, are not fine enough, they need only be warm'd a little in the Spoon: Or the Spirits may be lighted a little before, and blown out again, before they are brought to the electrical Body.

In this manner I have kindled, with the electrical Sparks, camphorated Spirits of Wine, coloured with Saffron, the common *Essentia vegetabilis*; and even French Brandy, and Corn-Spirits, only taking the Precaution of warming these Liquors a little before.

Even Oil, Pitch, and Sealing-wax, may be lighted by the electric Sparks, provided they are before heated to a Degree that is next to kindling.

X. *Translation of a Letter from Mr. Abraham Trembley, F. R. S. to the President, with Observations upon several newly discover'd Species of Fresh-water Polypi.*

S I R, *Sorgviet, 6. Nov. 1744. N. S.*

Read Nov. 22. 1744. **I**HAVE herewith the Honour of trans-
mitting to you the Particulars of
several Observations I have made, during the Course
of the last Summer, upon some Species of very mi-
nute Water-Animals; and which are the same
I have already made some Mention of, in the
third Paragraph of the 297th Page of the *Memoires*
pour servir à l'Histoire des Polypes à Bras en forme
Y 2 *de*

de Cornes. Mr. *De Reaumur* judges them all to belong to the general Class of the *Polypi*; and he has already distinguished and distributed the several Species of them, to which he has given the respective Names that I have made use of in the inclosed Abstract of my Observations.

I am very sensible, that some Passages of this Account will hardly appear sufficiently intelligible, to such as have not yet taken Notice of the little Creatures I am speaking about: But this Inconvenience I could not entirely have avoided, without entering into too particular a Detail of Facts, which I have not yet prosecuted so far as I intend, and which I could not besides have throughly explained, without the Assistance of a great Number of Figures.

I hope, notwithstanding, that what I have said will abundantly shew how singular the *Animalcula* in Question are, and how well they deserve Notice and Consideration. I shall neglect no Opportunities of pursuing their History; thereby to enable myself hereafter to give a more perfect Account of what I shall have further learned in my Enquiries. But this cannot be done immediately, as a considerable Time is required, for the making of accurate, repeated, varied, and well-connected Experiments.

In the mean time, as I have always made it my Pleasure, I shall even look upon it as a Duty, to be at all Times ready to satisfy the Curiosity of such as are Lovers of Natural History, with regard to the several Particulars that may present themselves, and that I may think worthy of their Attention.

I shall

I shall only add further, that I have already communicated these Observations to several Persons of the greatest Knowledge and Distinction, who have been pleased attentively to examine the same, and thereby given me the Satisfaction of having the best and most unexceptionable Witnesses to all the principal Facts that are mention'd in the inclosed Account; which I now put into your Hands, and remain, with the truest Respect,

S I R,

Your most humble,

and most obedient Servant,

A. Trembley.

WE find, in divers Places, upon Water-Plants, and other Bodies in the Water, a whitish Substance, that looks at first only like a sort of Mould: We sometimes see Plants, Sticks of Wood, Snail-shells, and the like, that are entirely covered over with this Substance. But if we take any of these, put them into a Glass of clear Water, and then examine with a magnifying Glass what is upon them, we soon discover, in the little Bodies, that, by their Assemblage, form this whitish Substance, such Motions as give sufficient Reason to look upon them as living Animals; and this will appear yet more sensible, when they come to be observed with a Microscope. We then find them to be minute Bodies, severally fixed to the Extremities of small Stems, or Pedicles, many

many of which are often so united, as to form together a Sort of Branches, or *Clusters* ; and this Sort of Appearance determined Monsieur *De Reaumur* to name the *Animalcula* that appeared so fixed, *clustering Polypi: des Polypes en bouquet.*

These Clusters are larger or lesser, according to the Species of the *Polypi* that form them, and according to the Concurrence of many other Circumstances.

To get a clear Idea of the Figure of these Animal's, it is best to observe the smaller Clusters ; as, in the larger, the great Number of the *Polypi* upon the several Stems, are apt to hide one another.

There is a Case, I shall mention presently, where the *Polypi* are single ; and it is proper to observe them in that Case ; and the rather, because that is the Way to discover how the Clusters are formed.

I shall now describe one of these single *Polypi*, to give a general Idea of the Form of the Animal : and I shall herein chiefly endeavour the Description of that Species which I have most particularly made my Observations upon.

These are not in Length above the 240th Part of an Inch, and are of a Shape nearly resembling that of a Bell : this may be seen in the Figure, where one of them is represented exceedingly magnified (TAB. II. Fig. 5.). The anterior Part, *ac*, generally appears open, when it properly presents itself ; the posterior Part *b* is fixed to a Stem or Pedicle *be* ; and it is by the Extremity *e* of this Pedicle, that the *Polypus* fastens itself to any other Sort of Body. The *Polypus* of this Sort generally appears to the Microscope of a brownish Colour, excepting at its smaller End *b*, where it is transparent, as well as its Pedicle *be*. When the anterior Part *ac* is open, one may perceive

ceive about its Edges a very lively Motion ; and when the *Polypus* presents itself in a certain manner, it discovers, on either Side of these Edges of its anterior Part, somewhat very much resembling the Wheels of a little Mill, that move with great Velocity.

These *Polypi* are able to contract themselves ; and they do so often, and suddenly. They may be brought to contract at any time, either by touching them, or by moving the Body to which they are fixed. When they contract, the Edges of their anterior Parts are drawn quite into their Bodies ; and when they resume, which they do soon after, their former Posture, one may distinctly see those Edges come forth again, and put themselves in Motion, as before.

When one looks about the anterior Parts of these *Polypi*, which are open, and whose Edges are in Motion, one may frequently have an Opportunity of remarking a Number of very minute Bodies swimming in the Water, that seem to be forced down with Velocity into these Openings of their anterior Parts, and that sometimes are thrown out again from thence.

To make this Observation the most sensible, it is best not to look at a single *Polypus*, but a Cluster of some Numbers of them together.

I have taken Notice, that the *Polypi* of the Sort in Question, appear of a brownish Colour when viewed with the Microscope ; I should now add, that having left some of them for several Days in the same Water, they by degrees lost their brown Colour, and became transparent ; excepting only that a few Grains or Spots of Brown or Black, still continued

nued to be discernible in their Bodies : But, having afterwards removed these *Polypi* into other Water, newly taken out a Ditch, they in a little time resumed the same brown Hue which they had before.

It may commonly be observed, that when the *Polypi* are in Water newly put to them, there fall upon their anterior Parts far greater Numbers of the above-mentioned minute Bodies, than when they have been left for any time in the same Water.

It is very probable, that these minute Bodies are exceedingly small Animalcules, upon which the *Polypi* feed ; and that, consequently, the Opening which they have in their anterior Part, serves them for the Purposes of a Mouth.

The *Polypi* that have become transparent, and that have been left some time without the Addition of such Water as would make them recover their brown Colour, have also, at the same time, left off multiplying. But I have observed that others of them, to which I have afterwards given new Water from the Ditch, have soon after begun to multiply again.

These *Polypi* are capable of swimming about ; and when they swim, they are no longer in Clusters, but always single ; and they do not then appear in the same Form as when they are fixed, and open at their anterior Ends. It is by Swimming that they leave the Place to which they first appeared fixed, and that they go and fix themselves to any other Body that they find in their Way.

One should begin to observe a *Polypus* soon after it has fixed itself singly, in order to see regularly in what manner the Clusters form themselves, and in what Way these small Creatures multiply.

The

The Stem or Pedicle of a *Polypus* that is yet single, and which has but lately fixed itself, is at first very short, but it lengthens itself in a little time. After that, the *Polypus* multiplies; that is to say, it divides or splits itself into two lengthwise. One first observes the Lips to be drawn into the Body, whose anterior Part closes, and becomes round: the Motion that was to be seen before the Lips were drawn in, no longer appears; yet may one see, by looking with Attention, a slow Motion within the Body, during all the Time that the *Polypus* remains cloited. The anterior Part of the *Polypus* flats itself afterwards by degrees, and spreads in proportion, becoming broader as it shortens; it then gradually splits down through the Middle, that is, from the Middle of the Head to the Place where the posterior End joins to the Pedicle: so that, in a little while, there appear two separate round Bodies joined to the Extremity of the Pedicle that just before supported but one.

The anterior Part of each of these Bodies then opens by degrees; and, as they open, the Lips of the new *Polypi* shew themselves more and more. Then is the Time of observing these Lips with Attention, and of forming to one's Self an Idea of their true Form, and of their Motion already spoken of. This Motion is at the first very slow, it quickens as the *Polypi* continue to open; and, as soon as they have done, it becomes as swift as that which appeared in the Lips of the whole single *Polypus*, before it began to divide: and then these new *Polypi* may be looked upon as entirely formed.

They are, at first, less than the *Polypus* from which they were formed ; but they grow to the same Size in a very little time.

A *Polypus* is an Hour, or thereabout, dividing itself.

To have a tolerable Notion of this Operation, one must have seen it divers times, and in *Polypi* placed and situated in divers different Ways.

The Lips of these *Polypi* appear to be composed of four or five transparent Stripes, all which have an undulating Motion. Whilst the *Polypi* are opening, and that the Motion of their Lips is yet but slow ; one sees on either Side, when they are in a certain Position, what one is inclined to take for the Wheels of a Mill, in the *Polypi* that are quite formed, and whose Lips move very fast : but one now sees, while they are opening I say, what may be rather taken for four or five Fingers on either Side of their Mouths ; which alternately bend down and extend themselves every Instant, and to which the transparent Stripes above-mentioned appear to be fixed.

This should be observed often, and in as many various Attitudes as possible, to avoid being deceived by the taking of Appearances for Realities ; which happens more or less to every Observer, more especially when he first begins to observe. Before I venture to explain myself more particularly upon this last Article, I shall endeavour to repeat and to pursue further, if I am able, some Observations that I have at present only begun.

When the first *Polypus* is thus divided, and the two new ones produced by this Operation are thus completed ; one sees on one Pedicle two *Polypi*, joined

to its Extremity by their posterior Ends, and that shew themselves on the Sides of each other, as in TAB. II. *Fig. 6.*

The ordinary Proportion between the Length of the Body of one of these *Polypi*, and the Length of their Pedicle, is pretty exactly observed in the Drawings.

Soon after the Separation is compleated, each of the new *Polypi* begins to shew a Pedicle of its own.

I have often had Occasion to take notice, that each of the new *Polypi* had, the Day after their Separation, a Pedicle of a tolerable Length; and that these new Pedicles united at the Extremity of the first Pedicle, as the Branches of a Tree unite at its Trunk.

Several of the *Polypi*, upon which I have made continued Observations, have multiplied at the latest 24 Hours after their first Separation. The new Cluster has then consisted of 4 *Polypi*, each of which had its own Pedicle; as every one has also had, that was afterwards produced by a new Separation.

The next Figure represents a Cluster of eight *Polypi*; and by this Figure it may be apprehended in what manner the Pedicles of the *Polypi* become disposed, as their Numbers increase. These several Pedicles become so many Branches of the Cluster or Sprig. TAB. II. *Fig. 7.*

This Figure particularly represents a Cluster, whose Progress I followed in the Month of *September* last, 1744. It consisted, on the 9th Day of that Month, but of one single *Polypus*, which was placed as at *b*: this *Polypus* divided itself that Evening, and at half an Hour after Eight of the Clock, there were to be

discovered at *b* two perfect *Polypi*, whose Pedicles or Branches, *bd*, *bd*, continued lengthening till the Morning of the next Day, being the 10th of the same Month of *September*: at about a Quarter after Nine that Morning, these two *Polypi*, which were then at *d*, *d*, began also each to divide; so that at a Quarter past Eleven, there were at *d* and *d* four compleat *Polypi*, whose several Pedicles *di*, *di*, *di*, *di*, formed themselves soon after. On the 11th of the same *September*, about half an Hour after Seven in the Morning, I found that these four last *Polypi* had already again divided themselves; that is to say, that there were at *i*, *i*, *i*, *i*, eight distinct *Polypi*; and this Cluster, so consisting of eight *Polypi*, is here represented as it appeared upon the 12th of the same Month, between Ten and Eleven in the Forenoon.

The *Polypi* are not always ranged as they are disposed in this Figure; for it often happens, that the Pedicles and the *Polypi* are behind one another, so as to form a Groupe, in which some of the *Polypi* may chance to be hidden or covered by others, either entirely, or in Part.

This Figure represents the *Polypi* and Pedicles as magnified to the same Degree as those already exhibited in the former Figures.

I have taken notice of Clusters, the Numbers of whose *Polypi* have constantly gone on doubling, from 2 to 4, from 4 to 8, from 8 to 16, from 16 to 32: after which I have no longer been able to count exactly the Number of the *Polypi*.

I have said enough, to shew how the Clusters are formed, and how fast these small Animals multiply: Indeed

Indeed the Number is prodigious of those that are sometimes found in the Water.

I have large Glasses by me at this time, Nov. 1. 1744. N. S. in which they have exceedingly multiplied; there is particularly, in one of them, a Cluster composed of several lesser united Clusters, which is above an Inch over every way.

There detach themselves from time to time single *Polypi*, which go swimming about till they fix each upon some Body or other; and from these there again arise new Clusters, in the manner above spoken of.

The Branches, from which *Polypi* have detached themselves, still remain fixed to the Cluster, but they bear no more *Polypi*; and after all the *Polypi* of a Cluster have thus detached themselves from it, the Assemblage of the Branches still subsists, but is of no further Use.

I know of four other Species of *Polypi*, that all increase in the same manner as those I have been already speaking of; that is to say, which split and divide themselves according to their Length.

Those which come the nearest to the first, are somewhat more slender, and the Branches of their Clusters are transparent; yet do they appear, when there is a Number of them together, of a changeable Violet-Colour: the Clusters of these bear a good Resemblance to a Sprig or *Aigrette* of spun Glass.

When these last Animals are compleatly formed, it is not so easy to see distinctly in them the Motion of their Lips, as it is in the other Species before-mentioned; yet may it be observed in these also, whilst they are still opening, and compleating their Formation: for at such times, this Motion is

but slow, whereas it becomes afterwards very quick in those that are entirely perfected.

The *Polypi* of the other Species that I have observed, are yet less than the last; they are shorter, but more open and hollow'd at their anterior Ends. These have a Character that sufficiently distinguishes them from all the other Species: their Stems and Branches have a Motion that is not to be found in those of the other *Polypi*. These Stems draw themselves up, and shorten all at once, taking the Form of a spiral Wire or Screw; and a Moment after they again resume their former Shape, stretching themselves out strait as before.

These several Species of *Polypi* I have been speaking of, all multiply in vast Abundance; but they have also Enemies that destroy immense Numbers of them, and that in a very little time.

I have also this Summer observed regularly other small *Polypi*, of a different Sort from those that are found in Clusters. These are nearly in Shape like a Tunnel, pretty long in proportion to the Opening of their larger Ends. For this Reason, Mr. *De Reaumur* has thought proper to distinguish them by the Name of *Tunnel-like Polypi*.

I am acquainted with three Species of these last *Polypi*, which are respectively, green, blue, and white.

These must also be observed often, and in various Attitudes, in order to obtain a tolerably exact Notion of their proper Structure.

Their anterior End particularly, is of a far more compounded Shape, than one would at first imagine.

There may be discovered, round the Edges of this Part, a sensible Motion, much resembling that of an indented Wheel, or rather of an endless Screw, that is turned very fast about.

These *Tunnel-like Polypi* form no Clusters, like the others.

I have remarked, that the little Bodies, that pass swimming near the anterior Parts of these Insects, are in some manner drawn into the Mouths of their Tunnels; and I have sometimes seen a considerable Number of very small round *Animalcula* fall one after another into these Openings. Some of these were indeed afterwards let out again, at another Opening, which I am not yet able particularly to describe: but I could plainly see, that many of these little round Bodies remain'd within the Bodies of the *Polypi*; and it is therefore apparent, that these little Bodies, so taken in, became their Food.

These *Tunnel-like Polypi* do also multiply by dividing themselves into two, but they divide themselves otherwise than the *clustering Polypi*: they neither divide longitudinally nor transversly, but sloping and diagonal-wise. Of two *Tunnel-like Polypi*, just produced by the Division of one, the first has the old Head and a new posterior End; and the other the old posterior End, with a new Head.

I shall call that which has the old Head, the *superior Polypus*; and that which has the new Head, the *inferior one*.

The first Particulars observable in a *Tunnel-like Polypus* that is going to divide, are the Lips of the *inferior Polypus*; I mean those transparent Edges that are so conspicuous in the *Polypi* when entirely formed. These new Lips first discover themselves upon the

Poly-

Polypus that is going to divide, from a little below the old Lips, to about two Thirds of the Length of the *Polypus*, reckoning from the Head: but these new Lips are not dispos'd in a strait Line, according to the Length of the *Polypus*, but run sloping near half-way round about. These Lips are known by the Motion in them, but which Motion is at first very slow. That Portion of the Body of the *Polypus*, that is bounded by these new Lips, then gathers up itself, the new Lips insensibly draw together and close; whereby there forms itself, at the Side of the *Polypus*, a Swelling, that is soon found to be the Head of the new one, bounded by the new Lips first discover'd. Before this Swelling is grown very remarkable, one begins to distinguish the two *Polypi* which are forming themselves; and when that Swelling is considerably increased, the two *Polypi* will be discovered, no longer joined but by a small Portion to each other. The *superior Polypus* no longer adheres to the inferior one, but by its posterior Extremity, which is still fixed on one Side of the *inferior Polypus*: The *superior Polypus* then begins to make Motions that seemingly tend to the separating of him from the other; and in a little time he becomes quite detach'd, swims away, and fixes himself elsewhere. I have seen one come and fix at the Side of the *inferior Polypus*, from which he was just before separated. The *inferior Polypus* remains fixed in the same Place, where the *Polypus* was that is now divided, and of which he was only the Half, before the Division took place.

I am not, at present, able to enter into a further Detail of the Manner in which these *Tunnel-like Polypi* divide and multiply themselves. I could not do

do it, without the Assistance of many Figures, nor without the Mention of several other Facts, that I have not yet sufficiently satisfied myself about, nor observed so often as I think it necessary to do.

I shall also endeavour to carry on further the Natural History of all the several *Polypi* of which I have yet spoken, and, perhaps, that of some other Sorts besides; as I find, that the Experiments I make upon Insects of one Species, facilitate in several Respects those I have to make upon others; and that these last often throw a new Light upon Observations and Experiments already made.

As all these little Animals are exceedingly minute, I have hardly been able to observe any of the several Facts above-mentioned without the Assistance of the *Microscope*; but, if I was to take such small Objects out of the Water, in order to expose them to my Glasses in the common Way, I should both risque the losing of them, and hazard the putting them out of a Condition of performing their natural Operations. I am therefore forced to observe them with the Magnifiers of my Microscope, without taking them out of the Glasses I keep them in. I, for this Purpose, contrive to get them so near the Sides of those Glasses; that the *Foci* of my Magnifiers may reach them from without: I then fix, by the Sides of my Glasses, a jointed Arm I have fitted for that Purpose, into the Socket of which I can conveniently screw the different Magnifiers of my Microscope, and retain them fixed at their due Distances, by which I am able, with great Ease, to keep the *Amimalcula* in Sight as long as I have Occasion for them: and I use for the most part the Light of a wax Taper, to illuminate my Objects.

Fig. 1.

p. 158.

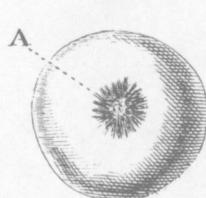
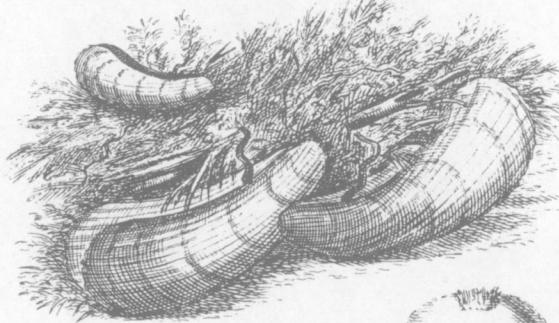


Fig. 12. p. 238.

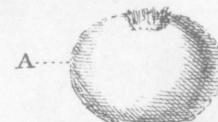
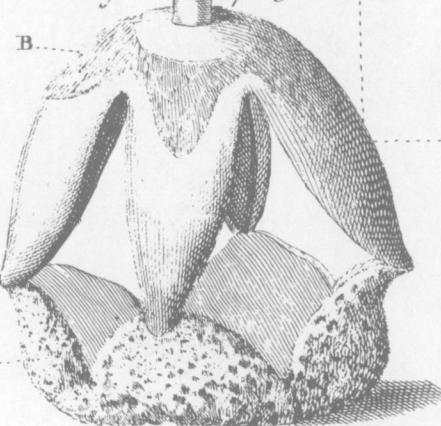


Fig. 11. p. 238.



C.

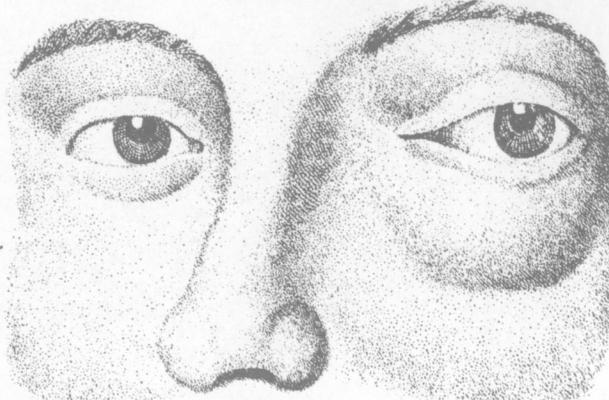


Fig. 8.

p. 195. 200.

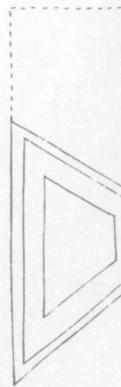
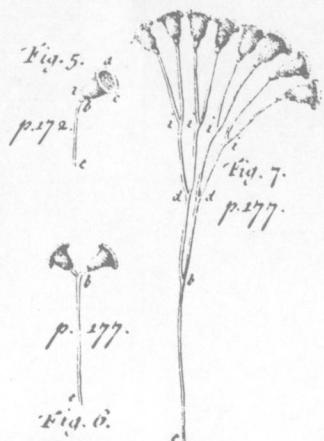


Fig. 2. p. 160.

IMP·CAES·M·AVRE
SEVERO·ANTONI
PIO·FELICI·XXXG·PART
MAX·BRIT·MAX·GER
MAX·PONTIFICI·MA
TRIB·POTEST·XVIII·I
COS·III·PROCOS·PP·C
FIDA·WARDVL·CREO
NNANA·FECIT·SVB·
LEG·

Fig. 10. p. 208.



p. 177.

Fig. 6.

p. 177.

Fig. 7.



Fig. 2. p. 160.

IMP·CAES·M·AVRELIO
SEVERO·ANTONINO
PIO·FELICI·XXG·PARTHIC·
MAX·BRIT·MAX·GERM·
MAX·PONTIFICI·MAXIM·
TRIB·POTEST·XVIII·IMP·II·
COS·III·PROCONS·PP·COH·I·
FIDA·VARDVL·CREOANO
NNANA·FECIT·SVB·CVRA·
LEG·XX·GR

Fig. 3. p. 160.

MARTI
VICTORI
VLIVS LI
IVS TRIE
V·S·L·M.

Fig. 4. p. 160.

FORTVNAE
AVG
A E T
PROCVLINA
V S

Fig. 10. p. 208.

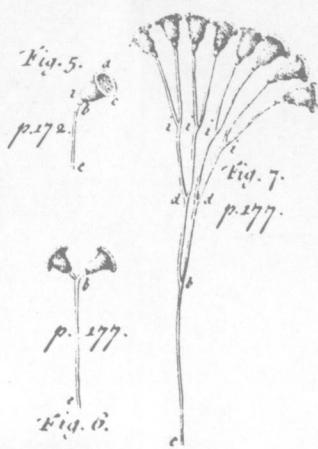
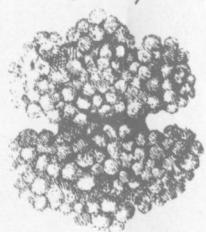


Fig. 6.

Fig. 9. p. 201.

DEO·HER
SAEG ON
T·TAMMON
SAE·TAMMON
VITALIS
HON